



Comparison of inflammatory level and symptom level in cases having chronic rhinosinusitis

Quality of life of chronic rhinosinusitis

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Abstract

Aim: The aim of this study was to investigate whether the endoscopic findings, coronal computed tomography data and the level of histopathological changes observed in tissue samples had any effects on the quality of life in chronic rhinosinusitis cases. **Material and Method:** In this prospective study, 34 patients diagnosed with chronic rhinosinusitis (Group 1) and 34 volunteer individuals having no chronic rhinosinusitis (Group 2) were included. Detailed anamnesis, endoscopic examination findings, quality of life in patients with chronic rhinosinusitis questionnaire scores and coronal paranasal computed tomography scores were recorded in the files of all the cases. Endoscopic evaluation findings were evaluated using the Lund-Kennedy scoring system, all the cases were given a chronic rhinosinusitis evaluation questionnaire, coronal paranasal computed tomography findings were scored using the Lund-Mackay system. **Results:** The average quality-of-life score, the average radiological score, the average endoscopic examination score, the histopathological evaluation of the surgical specimens, the average inflammatory score, the average fibrosis scores and the average osteoblastic-osteoclastic score was statistically different between two groups. When a correlation analysis was performed, the quality-of-life scores were found to have a negative correlation with the radiological scores, endoscopic scores, fibrosis scores and osteoblastic-osteoclastic activity scores in Group 1. And also radiological scores were positively correlated both with the endoscopic scores and the osteoblastic-osteoclastic activity scores and a positive correlation was found between the endoscopic scoring and the mucosal inflammation in Group 1. **Discussion:** The results of our study showed that the histopathological changes affected the quality of life negatively.

Keywords

Chronic Rhinosinusitis; Quality-of-Life; Histopathological Changes; Lund-Kennedy Scoring System; Lund-Mackay System

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Introduction

Chronic rhinosinusitis (CRS) have been defined based on the presence of characteristic symptoms and objective evidence of mucosal inflammation [1]. Chronic rhinosinusitis is a heterogeneous group of chronic sinus diseases that consists of chronic inflammatory diseases either accompanied with polyp formation or without polyps and is characterized by inflammation of nasal cavity, paranasal sinuses, fluids in these cavities or the bony structures under these cavities for at least 12 weeks [2]. It has been shown by subgroup analyses that baseline severity and outcomes can be affected by various demographic factors and comorbidities [3,4].

Due to decreased quality of life, loss of work productivity and increased treatment costs, chronic rhinosinusitis has a burden on public health and economy [5]. For this reason, the aim of rhinosinusitis treatment is not only to treat the disease but also to increase the quality of life. In the literature, there are many studies conducted on this issue in recent years. Majority of these studies point out to the association between the treatment methods and the quality of life [6,7,8,9].

In the present study, our aim was to investigate whether the endoscopic findings, coronal computed tomography data and the level of histopathological changes observed in surgical tissue samples had any effects on the quality of life in chronic rhinosinusitis cases.

Material and Method

In this prospective study, 34 patients diagnosed with chronic rhinosinusitis by ENT Department (**Group 1**) and 34 volunteer individuals having no chronic rhinosinusitis but indicated for operation due to septum deviation (Control Group) (**Group 2**) were included. The patients included in the study were diagnosed with chronic rhinosinusitis at the ENT polyclinic in accordance with the rhinosinusitis workgroup of the American Academy of Otolaryngology-Head and Neck Surgery [1]. Necessary permission was taken from the Ethical Committee of Cumhuriyet University and all the patients were asked to sign a consent form.

For the patients in Group 1, the inclusion criteria were having an indication for endoscopic sinus surgery after failing an optimum medical treatment. The inclusion criteria were refusing surgical treatment, not giving consent to participate in the study, having a history of surgical treatment for similar complaints or having a history of trauma and malignancy. In the Control Group, having a history of sinus surgery or having a complaint of chronic sinusitis were regarded as exclusion criteria.

Detailed anamnesis, endoscopic examination findings, chronic rhinosinusitis quality of life questionnaire scores and coronal paranasal computed tomography scores were recorded in the files of all the cases.

Endoscopic evaluation was carried out by a single researcher (MD) in all the cases while the related findings were evaluated using the Lund-Kennedy scoring system [10,11].

To assess the quality of life, all the cases were given a chronic rhinosinusitis evaluation questionnaire. The scores of the questionnaire ranged between 0 and 100 where zero indicated no resolution of symptoms despite medical treatment for more than 7-8 weeks and 100 indicated having no symptom for more

than 8 weeks [12].

All the patients included in the study underwent coronal paranasal computed tomography and the related findings were scored using the Lund-MacKay system [13,14].

Samples to be used for histopathological examinations were obtained during endoscopic sinus surgery from the regions macroscopically thought to be infected in Group 1. Similarly, samples were obtained from the regions thought to be infected in Group 2. These samples were fixed in 10% formaldehyde and embedded in paraffin blocks. Paraffin blocks were then sectioned in 5 µm thickness, tissues were stained by hematoxylin-eosin and examined by a single researcher (ET) under a light microscopy. For an unbiased evaluation, the researcher performing the histopathological examination was blind to the patient and control groups.

Bone inflammation grading, periosteal thickening level, osteoblastic-osteoclastic activity and new bone formation scoring were carried out using the criteria of Beidlingmaier et al. [15] where the scores ranged between 0 and 4 (0=normal; 1=minimal periosteal thickening; 2= mild periosteal thickening with osteoblastic-osteoclastic activity; 3= moderate periosteal thickening with osteoid accumulation and osteoblastic-osteoclastic activity; 4=severe periosteal thickening and marrow formation. Mucosal inflammation was scored between 0 and 4 (0=normal, 1= minimal, 2=mild, 3= moderate, 4=severe) based on the amount of infiltrated inflammatory cells (lymphocytes, eosinophil and plasma cells). Fibrosis was evaluated semi-quantitatively based on the modified histological scoring of Ehrlich et al. [16]. Accordingly, scoring was as follows: 0= no fibrosis, 1= sparse fibrosis, 2= mild fibrosis 3= moderate fibrosis, 4=severe fibroblastic development and collagen presence.

In Group 1, all the patients underwent endoscopic sinus surgery after failing an optimum medical treatment. Based on the severity of the disease, middle meatal antrostomy was performed in 34 (100%) patients, ethmoidectomy was performed in 10 (29.41%) patients and frontal sinusotomy was performed in 6 (17.65%) patients.

Of the 34 patients in Group 2, bone and mucosa samples were taken during concha bullosa resection due to infected concha bullosa in 24 patients (70.58%), during middle turbinate plasty due to hypertrophic turbinate in 8 patients (23.53%) and septoplasty on the perpendicular lamina of ethmoid bone due to septal deviation in 10 patients (29.41%).

The obtained findings were recorded and evaluated using the SPSS 14.0 program (SPS Inc., Chicago IL, USA) while the data were studied using Man-Whitney U test, Chi-square test, Pearson correlation analysis and independent t-test. The statistical significance level was taken as 0.05, and p values less than 0.05 were regarded as significant.

Results

The average age was $34,2 \pm 10,6$ years (min-max 18-59 years) in Group 1 and $32,0 \pm 8,6$ years in Group 2 (min-max 18-46 years). Of the 34 patients included in Group 1, 12 were females (35.29%) and 22 were males (64.70%) while Group 2 had 14 females (41.18%) and 20 males (58.82%). In terms of age and gender, there was no statistically significant difference between the groups ($p>0,05$).

The average quality of life score was $30,6 \pm 9,2$ in Group 1 and $86,2 \pm 9,1$ in Group 2. When Group 1 and Group 2 were compared in terms of the quality of life scores, the difference between the groups was statistically significant (**Graphic 1a**). When the coronal computed tomography images of the patients included in the study were graded using the Lund-MackKay scoring, the average radiological score was $8,6 \pm 2,6$ in Group 1 and $0,5 \pm 0,6$ in Group 2, and the difference between the groups was statistically significant ($p < 0,05$) (**Graphic 1b**).

The average endoscopic examination score was $6,2 \pm 2,1$ in Group 1 and $1,0 \pm 0,7$ in Group 2, and the difference between the groups was statistically significant ($p < 0,05$) (**Graphic 1c**). In the histopathological evaluation of the surgical specimens of 68 patients included in the study, the average inflammatory score was $1,3 \pm 0,5$ in Group 1 and $0,6 \pm 0,5$ in Group 2 ($p < 0,05$); the average fibrosis scores was $1,5 \pm 0,5$ in Group 1 and $0,5 \pm 0,5$ in Group 2 ($p < 0,05$) and the average osteoblastic-osteoclastic score was $1,3 \pm 0,6$ in Group 1 and $0,0 \pm 0,0$ in Group 2 ($p < 0,05$). In terms of histopathological evaluation, the differences found between the groups were statistically significant (**Graphic 1d, Figure 1**).

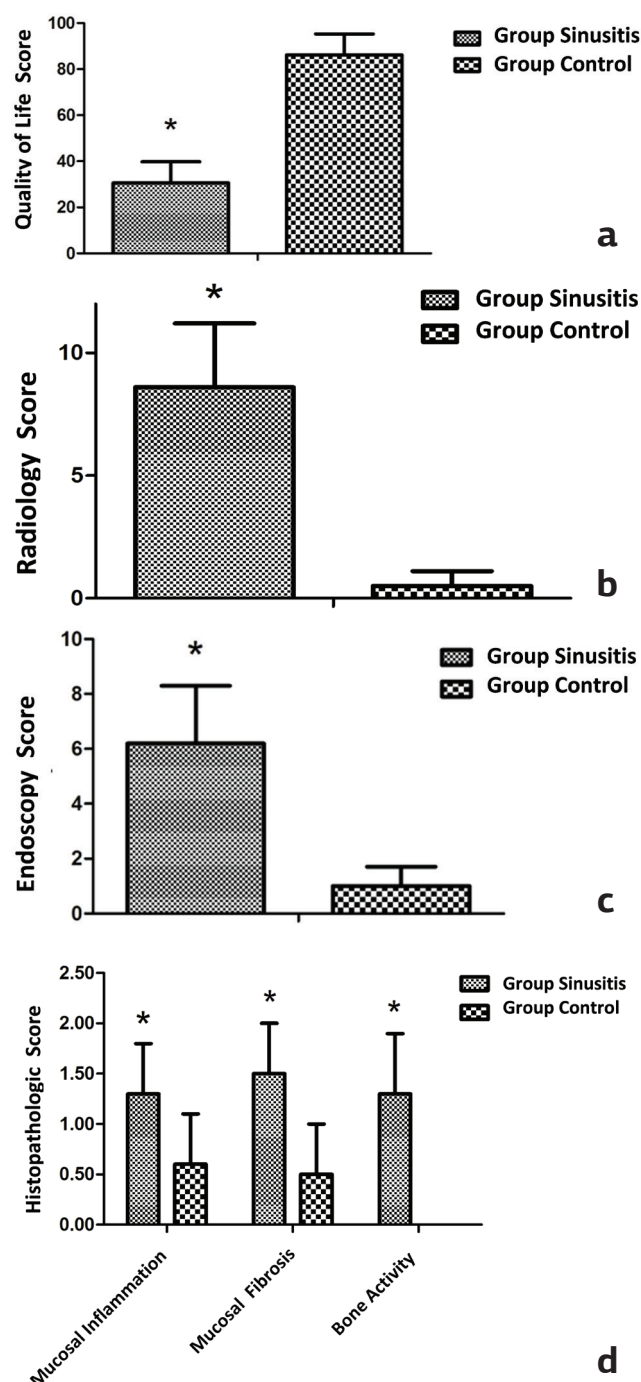
When a correlation analysis on the evaluated parameters was performed, the quality of life scores were found to have a negative correlation with the radiological scores ($p = 0,005$; $r = -0,47$) and endoscopic scores ($p = 0,03$; $r = -0,36$) in Group 1. Similarly, the quality of life scores had a negative correlation with the fibrosis scores ($p = 0,027$; $r = -0,38$) and osteoblastic-osteoclastic activity scores ($p = 0,021$; $r = -0,39$). In Group 1, radiological scores were positively correlated both with the endoscopic scores ($p = 0,001$; $r = 0,72$) and the osteoblastic-osteoclastic activity scores ($p = 0,02$; $r = 0,39$). A positive correlation was found between the endoscopic scoring and the mucosal inflammation as well ($p = 0,04$; $r = 0,35$). Mucosal inflammation showed a statistically positive correlation both with the mucosal fibrosis ($p = 0,02$; $r = 0,40$) and the osteoblastic-osteoclastic activity ($p = 0,001$; $r = 0,59$) (**Figure 1**). When a correlation analysis between the evaluated parameters was performed, no statistically significant correlation was found in Group 1.

Discussion

Chronic rhinosinusitis, which is a chronic common medical condition, has a significant impact on health-related quality of life. Histological inflammatory markers are important in determining the severity of chronic rhinosinusitis.

In the present study, we aimed to investigate whether the histopathological changes observed in endoscopic examination findings, coronal computed tomography data and obtained surgical tissue samples had any effects on the quality of life. The obtained results showed that chronic rhinosinusitis affected the quality of life negatively and there were statistically significant differences between two groups in endoscopic examination findings. There are many studies in the literature, supporting these findings [17,18,19].

In a study conducted in Western China, Zheng et al. [17] investigated the correlation between the findings of computed tomography staging and chronic rhinosinusitis questionnaire. In the mentioned study, the Lund-MackKay CT staging system, a visual analogue scale (VAS), the 20-Item Sinonasal Outcome



Graphic 1. Quality-of-life scores of 68 patients included in the study (a). Radiological scores of 68 patients included in the study (b). Endoscopic scores of 68 patients included in the study (c). Histopathological evaluation of the surgical specimens of 68 patients included in the study (d).

Test (SNOT-20), and the Short Form 36 Health Survey (SF-36) were used. The SNOT-20, SF-36, and VAS scores correlated with each other. The CT stage was correlated weakly but significantly with the scores in the questionnaires (such as SNOT-20, SF-36 and VAS) only in chronic rhinosinusitis with nasal polyps subgroup. Having nasal polyps was not associated with poor QoL in CRS patients.

In a study by Hopkins et al. [18], it was aimed to describe the relation of Lund-Mackay scoring to other measures of pre- and post-treatment health status.

It was found that the Lund-Mackay score measured a different aspect of disease to “subjective” symptom scores and corre-

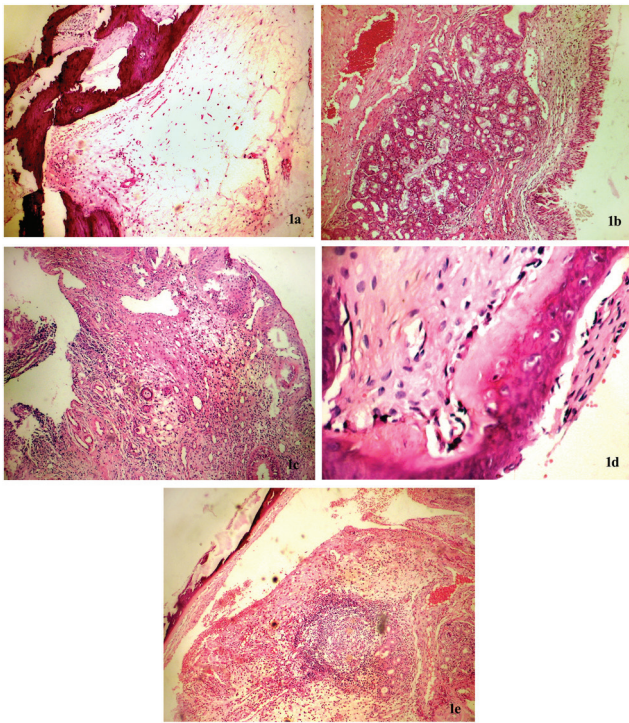


Figure 1. Mucosal area with mild inflammatory process, edema and normal bone trabeculae (inflammation=1, fibrosis=0, bone=0) (HE; X100) (a). Nasal mucosa with mild fibrosis and inflammation (severity score=1) (HE; X 100) (b). Squamous metaplasia in mucosa, moderate chronic inflammation (inflammation score=2), decrease in submucosal glands and mucosa with moderate fibrosis (fibrosis score=3) (HE; X100) (c). Increased osteoblastic activity in the bone tissue and periosteal thickening (bone score=3) (HE; X400-HE;X100) (d). Increased osteoblastic activity around the bone, mild accumulation of osteoid and periosteal thickening (bone score=3), moderate inflammatory infiltration in submucosa (inflammation score=2), moderate decrease in submucosal glands and moderate fibrosis (fibrosis score=2) (HE; X100) (e).

lated well with other markers of disease severity, the nature of offered surgery and the disease outcome.

In a study conducted by Wabnitz et al. [19], the correlation between preoperative symptoms, quality of life questionnaires (chronic sinusitis survey and 20-Item Sinonasal Outcome Test [SNOT-20]) and staging on computer tomography (CT) was evaluated. It was found that the score obtained by the sum of five sinonasal VAS symptoms correlated to the disease severity as measured by the Lund-MackKay CT scan score. Although there was a correlation between the chronic sinusitis survey score and the Lund-MackKay CT score in various sub-groups of their patient population, the SNOT-20 questionnaire, and the chronic sinusitis survey symptom score did not correlate to the Lund-MackKay CT scan score.

Similar to the mentioned studies in the literature, our study showed that the quality of life scores had a negative correlation both with the radiological scores and the endoscopic scores in patients from Group I. Moreover, radiological scores were found to have a positive correlation both with the endoscopic scores and the osteoblastic-osteoclastic activity scores in Group 1 patients. Endoscopic scoring and mucosal inflammation had a statistically significant correlation too.

Our literature review revealed very few number of studies evaluating the effects of histopathological evaluation of tissue samples obtained in surgical treatment on the quality of life [20,21]. In the study conducted by Soler et al. [21] in 2009, adult patients with chronic rhinosinusitis were enrolled prospectively and demograph-

ic data and medical comorbidities were recorded.

Computed tomography was used to measure the severity of the disease while the presence of mucosal inflammation, including cellular (eosinophils, neutrophils, lymphocytes, mast cells, plasma cells, macrophages), epithelial (squamous metaplasia, basement membrane thickening, goblet cells) and stromal markers (subepithelial edema, fibrosis) were examined through mucosal specimens. Mucosal eosinophilia was found to be correlated with objective disease severity as defined by CT, endoscopy, and SIT scores. The other histological markers present did not show any correlation. Similarly, there was no correlation between the presence of mucosal eosinophils and the quality of life scores. In 2013, Soy et al. [20] evaluated the association between histological parameters and the quality of life questionnaire in patients with chronic rhinosinusitis with nasal polyps after endoscopic sinus surgery. Preoperative patient characteristics, clinical findings, and computed tomography scores of the study population composed of 57 patients were recorded. Two quality of life measures, namely the Rhinosinusitis Disability Index (RSDI) and Short Form-36 General Health Survey (SF-36) were analysed preoperatively and postoperatively. Presence of inflammation was evaluated with cellular (eosinophils, neutrophils, lymphocytes, mast cells, macrophages), epithelial (basement membrane thickness [BMT], goblet cells) and stromal markers (subepithelial edema) in sinus mucosal specimens collected at the time of surgery. It was reported that mucosal eosinophilia did not correlate with the absolute change of RSDI. However, thickening of basal membrane had a negative effect on the symptoms of the patients and correlated with the disease severity.

In our study, contrary to the studies conducted by Soy et al. [20] and Soler et al. [21], no negative correlation was found when the quality of life scores was compared to the mucosal fibrosis scores and osteoblastic-osteoclastic activity.

Conclusion

There is a close association between disease severity and quality of life in cases having chronic rhinosinusitis. Due to decreased quality of life, loss of work productivity and increased treatment costs, this disease has a burden on public health and economy. In the literature, there are few studies showing that the histopathological changes in chronic rhinosinusitis cases may have effects on the quality of life. Similarly, the results we obtained in our study showed that the histopathological changes affected the quality of life negatively. For this reason, we believe that conducting larger studies on the association between histopathological changes and the quality of life would be useful.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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